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Mathematical and numerical analysis for interface motion arising in nonlinear phenomena

edited by Ken-Ichi Nakamura, Shigetoshi Yazaki and Tetsuya Ishiwata

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Research Institute for Mathematical Sciences
Kyoto University

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The papers presented in this volume of RIMS Kôkyûroku Bessatsu are in final form and refereed.

Preface

This volume is the collection of papers submitted by speakers of the RIMS Workshop "Mathematical and numerical analysis for interface motion arising in nonlinear phenomena" held at Research Institute for Mathematical Sciencese, Kyoto University, in July 12 – 14, 2011.

From mathematics and physics, to chemistry, biology, and engineering, the clarification of complex spatio-temporal pattern formations and dynamics arising from nonlinear phenomena are principle research topics in various fields of the natural sciences. In the formation of such patterns, and in transitions to dynamic patterns, the propagation of a type of singularity referred to as the interface is playing an important role and the analysis of these interfacial motions are expected to have large implications for understanding the mechanisms of complex pattern dynamics. By extracting the equation of motion of the interface from the nonlinear partial differential equations describing the phenomena, recent developments in bifurcation theory, center manifold theory, and singular limit methods have enabled the success of several mathematical analyses of interfacial dynamics. However, conditions for which the existing mathematical approaches can be applied are limited and whereas complex spatio-temporal patterns can be reproduced, thanks in part to advances in computational performance, when compared to the vast numerical knowledge that is being obtained, one cannot say that the mathematical theory has developed to the same level for the rigorous treatment of such problems.

The purpose of this research meeting is to organize the mathematical and computational methods used in analysing problems related to specific interfacial dynamics arising from nonlinear phenomena, and towards the merger of these approaches for developing new analytic techniques. Through the presentation of results obtained by the active research from domestic and abroad, and via the discussions of the participants, we believe that this meeting has served to further the mutual understanding, regarding the mechanisms of complex interfacial dynamics appearing in nonlinear phenomena, between the fields of mathematical and numerical analysis.

All of the papers were strictly refereed. We would like to thank all the authors and the referees for their contributions to this volume.

Editors: Ken-Ichi Nakamura
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